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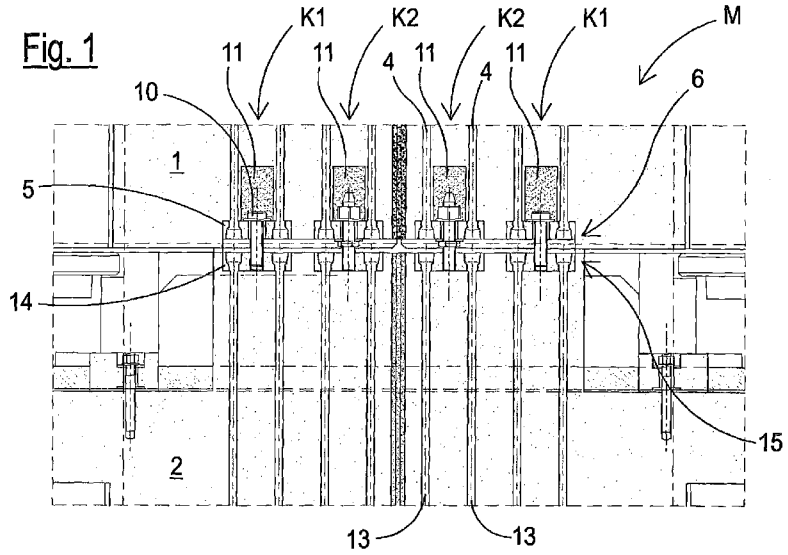
(54) Title: PREFABRICATED CONCRETE STRUCTURE FOR DRY-ASSEMBLED CIVIL BUILDINGS

Fig. 1



(57) Abstract: A structure (M) with prefabricated concrete elements (1, 2) comprises metallic connection means (4, 13) for the vertical superimposed connection of said prefabricated elements (1, 2), and blocking means (5, 14, 10; 19) of said connection means (4, 13); said connection means (4, 13) are englobed in said prefabricated concrete elements (1, 2), and said blocking means (5, 14, 10; 19) comprise screw fastening means (10; 19).

PREFABRICATED CONCRETE STRUCTURE FOR DRY-ASSEMBLED CIVIL BUILDINGS

The present invention relates to concrete structures entirely produced with dry-assembled prefabricated elements, for civil buildings.

In particular, the invention can be advantageously applied in the dry connection of walls, or vertical elements also called septa or walls for supporting vertical loads as rigid elements for absorbing the horizontal forces of floors, or horizontal elements also called tiles or beams which distribute horizontal plane actions on walls.

Italian patent nr. 1.364.674 Bl discloses the construction of walls by the vertical superimposing of prefabricated elements, in which each prefabricated element has a parallelepiped conformation and is provided with lightening perforations having a vertical longitudinal development.

Reinforcement cages defined by a plurality of metallic bars or rods having a variable diameter are suitable for being inserted and housed in said perforations .

During the laying of the wall structure, in order to provide an effective continuity by superimposition of the above-mentioned reinforcement cages, each prefabricated element is assembled on the underlying element with the cages inserted in holes into which concrete is cast so as to obtain a monolithic septum with continuous reinforcements over the whole height.

Although the wall solution with prefabricated elements described above has proved to be extremely-effective and reliable, it has a great disadvantage, however .

The necessity of having to cast the concrete inside the perforations, in fact, makes the laying of the wall described above lengthy and difficult for the following reasons :

- the verticality must be regulated with diagonal struts that cannot always be positioned,

- in order to fill the holes of each element with concrete, mixers and pumps are required for a limited quantity of concrete, with high costs and times,

- the operations described above cannot be effected if there are adverse weather conditions such as, for example, in the case of rain, low temperatures, in the presence of ice, etc.

An objective of the present invention is to overcome the drawback of the known art mentioned above.

In particular, an objective of the present invention is to provide a prefabricated structure which can be easily dry-assembled, i.e. without concrete castings, so that it is possible to operate with the maximum assembly rate as is the case for connecting metallic structures.

A second objective of the present invention is to provide a prefabricated structure in which the connection system of the walls coincides with the system for regulating its verticality.

A further objective of the present invention is to produce all of the structural components in the factory, already equipped with finishings and plants, so that at the end of the assembly, the construction thus built can be delivered directly without delay.

Another objective of the present invention is to provide a prefabricated structure having an optimum ductility in the case of seismic actions.

A further objective of the present invention is to provide a prefabricated structure which allows the above objectives to be obtained in an extremely simple, economical and particularly functional manner.

In view of the above objectives, according to the present invention, a prefabricated structure is provided, having the characteristics specified in the enclosed claims.

The structural and functional characteristics of the present invention and its advantages with respect to the known art will appear even more evident from the following description, referring to the enclosed drawings, which show some embodiments of a prefabricated structure produced according to the innovative principles of the same invention, in which:

- figure 1 illustrates a preferred embodiment of the prefabricated structure, object of the present invention, represented in a sectional view according to a vertical plane;

- figure 2 illustrates a second preferred embodiment of the prefabricated structure, object of

the present invention, represented in a sectional view according to a vertical plane;

- figure 3 illustrates a detail of the structure of figure 1, in a perspective view and on an enlarged scale;

- figure 4 illustrates a detail of the structure of figure 2, on an enlarged scale and with a partial vertical sectional view;

- figure 5 is an overall exploded perspective view of the components of the detail of the structure illustrated in figure 4;

- figure 6 is an overall exploded, partially sectional, perspective view of internal components of the detail of the prefabricated structure illustrated in figure 3;

- figure 7 is an overall exploded, partially-sectional, perspective view of internal components of the prefabricated structure of figures 1 and 2;

- figure 8 is a perspective view of the detail of figure 7;

- figure 9 represents a plan view of a further angled embodiment of the prefabricated structure, object of the present invention;

- figure 10 represents a front view of a detail of the structure of figure 1.

With reference to the enclosed figures, the prefabricated structure according to the present invention is indicated as a whole with M.

The structure M defines a surface or wall that

extends vertically, and comprises a first prefabricated element 1 having a parallelepiped conformation produced in concrete suitable for being assembled superimposed with respect to a second prefabricated element 2 again having a parallelepiped conformation and made of concrete .

According to what is illustrated in figures 1, 2, 3 and 6, at least a pair 3 of reinforced concrete bars 4 suitably spaced between each other is immersed and englobed in the concrete interior of the element 1 which also comprises a metallic plate 5 preferably having a substantially octagonal form, which is welded and positioned in correspondence with a lower end 6 of the prefabricated element 1.

The plate 5 comprises two cylindrical pass-through holes 7, substantially situated at the ends of the plate 5, at a certain distance from each other, and in which respective terminal ends 8 of the above-mentioned bars 4 are inserted and fixed.

The plate 5 also comprises a cylindrical pass-through hole 9 positioned in the centre of the same plate 5, and in which a screw 10 is suitably inserted and housed, in the assembly phase of the wall M, said screw being suitably inserted inside the concrete element 1 through a hollow seat 11 situated in the element 1 itself and through the interpositioning of washers R.

Again according to what is illustrated in figures 1, 2, 3 and 6, the element 2 contains, immersed in its

concrete interior, at least a pair 12 of reinforced concrete bars 13 suitably spaced between each other, and also comprises a metallic plate 14 preferably having a substantially octagonal form, which is welded and positioned in correspondence with an upper end 15 of the prefabricated element 2.

The plate 14 comprises two cylindrical pass-through holes 16, substantially situated at the ends of the plate 14, at a certain distance from each other, and in which respective terminal ends 17 of the above-mentioned cylindrical bars 13 are inserted and fixed.

The plate 14 also comprises a cylindrical threaded pass-through hole 18 positioned in the centre of the plate 14 itself, and in which the above-mentioned screw 10 can be suitably firmly screwed, in the assembly phase of the prefabricated structure M, with the element 1 superimposed with respect to the element 2.

In this way, the structure is consequently "dry"-assembled by fixed superimposition through screw connection means of the elements 1 and 2 with the injection between the two plates of a special high-resistant fluid mortar, which ensures the continuity in compression of the concrete, i.e. making the assembly of the structure rapid, effective and completely independent of atmospheric conditions.

According to what is illustrated in the embodiment of figures 1, 2, 3 and 6, the connection, indicated as a whole with the reference Kl, by superimposition of the elements 1 and 2, is obtained using a screw 10

suitably dimensioned with a higher resistance with respect to that of the bars 4 and 13, thus giving the same bars 4 and 13 a vertical continuity.

According to what is illustrated in the embodiment of figure 1 and in figures 7 and 8, the connection, indicated as a whole with the reference K2, by superimposition of the elements 1 and 2, is obtained using a screw 10 suitably dimensioned and with a truncated-conical terminal end suitable for being screwed not only in the threaded hole 18 but also in a die D, thus allowing a substantially self-centering assembly of the prefabricated structure and also regulating the verticality by plumbing the prefabricated structure and acting on a pair of dies D with a micrometric regulation.

According to what is illustrated in figures 2, 4 and 5, the connection, indicated as a whole with the reference K3 in figure 2, by superimposition of the elements 1 and 2, is obtained using a screw 19 having a certain length which is greater than that of the screws 10 of the above connections Kl and K2, said screw 19 is provided with a threaded end 19a suitable for passing through the hole 9 in the plate 5 and being screwed into a pair of corresponding dies D' suitable for regulating the verticality, and an opposite end 19b suitable for being screwed into the corresponding threaded hole 18 so as to enable the interpositioning of the tightening beam T of a plugging panel PT, which therefore remains firmly englobed in the structure.

Finally, it should be pointed out that for each structure M, there are two pairs of connections K2 or K3, or a pair K2 and a pair K3, which allow the centering of the structure and its vertical adjustment and as many connections Kl according to the static requirements (as illustrated in figure 9).

In order to be able to produce nuclei composed of wall structures and having torsional strength, an angular wall has also been constructed in which, in addition to the connections Kl, there are also three pairs of connections K2 or K3 to enable the registration of the verticality of the angular walls, subsequently adding connections of the above-mentioned type Kl. The necessity, especially for seism-resistant nuclei, of having a strong reinforcement, both flexural and shear, has led to the filling of vast wall sections with connections of the Kl type, with plates arranged at modular distances.

The dry-assembly of the structure is completed by positioning tiles on the top of the structure M, which are fixed with pins or pets (Figure 10) to create a rigid floor, without requiring collaborating castings to transfer the horizontal plane forces to the vertical walls.

CLAIMS

1) Structure (M) with superimposed prefabricated concrete elements (1,2), in particular for civil buildings, comprising metal connection means (4,13) for the vertical connection of said prefabricated elements (1,2) and blocking means (5,14,10;19) of said connection means (4,13); characterized in that said connection means (4,13) are consolidated in said prefabricated concrete elements (1,2); said blocking means (5,14,10; 19) comprise screw fastening means (10;19) .

2) Structure according to claim 1, characterized in that said connection means (4,13) are immersed in said prefabricated elements (1,2).

3) Structure according to claim 1 or 2, characterized in that said connection means (4,13) comprise, for each prefabricated element (1,2) at least a pair (3; 12) of reinforced concrete bars (4,-13).

4) Structure according to claim 3, characterized in that said blocking means (5,14,10; 19) comprise, for each prefabricated element (1;2), a plate (5;14) welded to the prefabricated element itself, in correspondence with an end (6; 15) of the prefabricated element (1;2) and fixed to said pair (3,-12) of bars (4; 13) .

5) Structure according to claim 4, characterized in that said fixing means (10) comprise a screw (10; 19) suitable for reciprocally fixing two of said plates (5,14) to each other, welded to respective two prefabricated superimposed elements (1,2).

6) Structure according to claim 5, characterized in that said screw (10; 19) is suitable for being inserted in a pass-through central hole (9) of one of said

plates (5) and being screwed into a central hole (18) provided with a threading of another plate (14) forming a connection capable of continuing, without interruptions, the assembly of an overlying plane.

7) Structure according to claim 5 or 6, characterized in that said screw (10) is truncated-conical, acting as a centering and for the micrometric regulation of the verticality through die fixing means (D).

8) Structure according to any of the previous claims from 4 to 7, characterized in that said screw (19) between two of said plates (5,14) has a longitudinal dimension which is such as to cross a tightening beam (T) of a plugging panel (PT); die fixing means (D') being envisaged for being screwed to said screw (19).

9) Structure according to any of the previous claims from 1 to 8, characterized in that a floor is positioned on the upper part of said structure (M) and fixed by pin or peg means.

Fig. 1

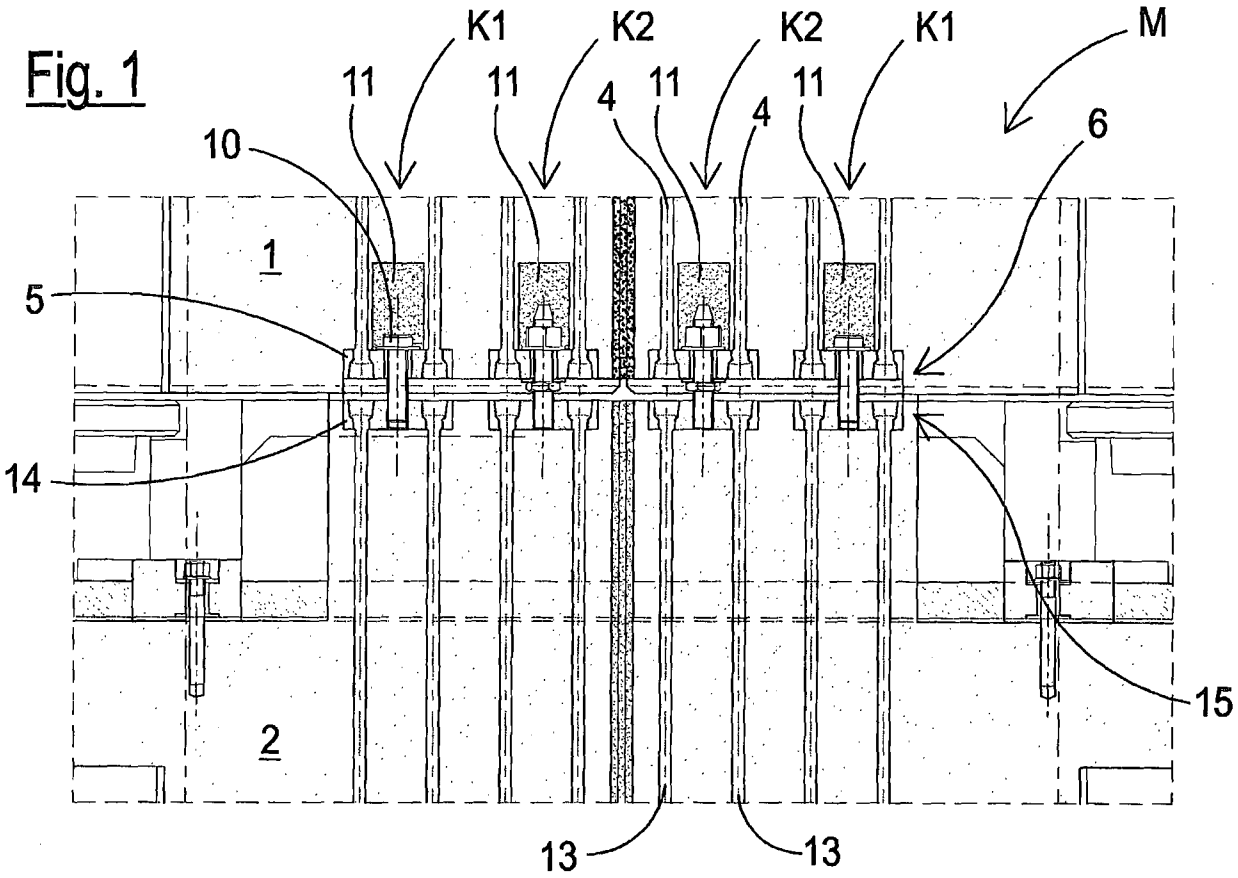

K1
K2
K2
K1
M
11
11
4
11
4
11
10
6
1
5
14
15
2
13
13

Fig. 2

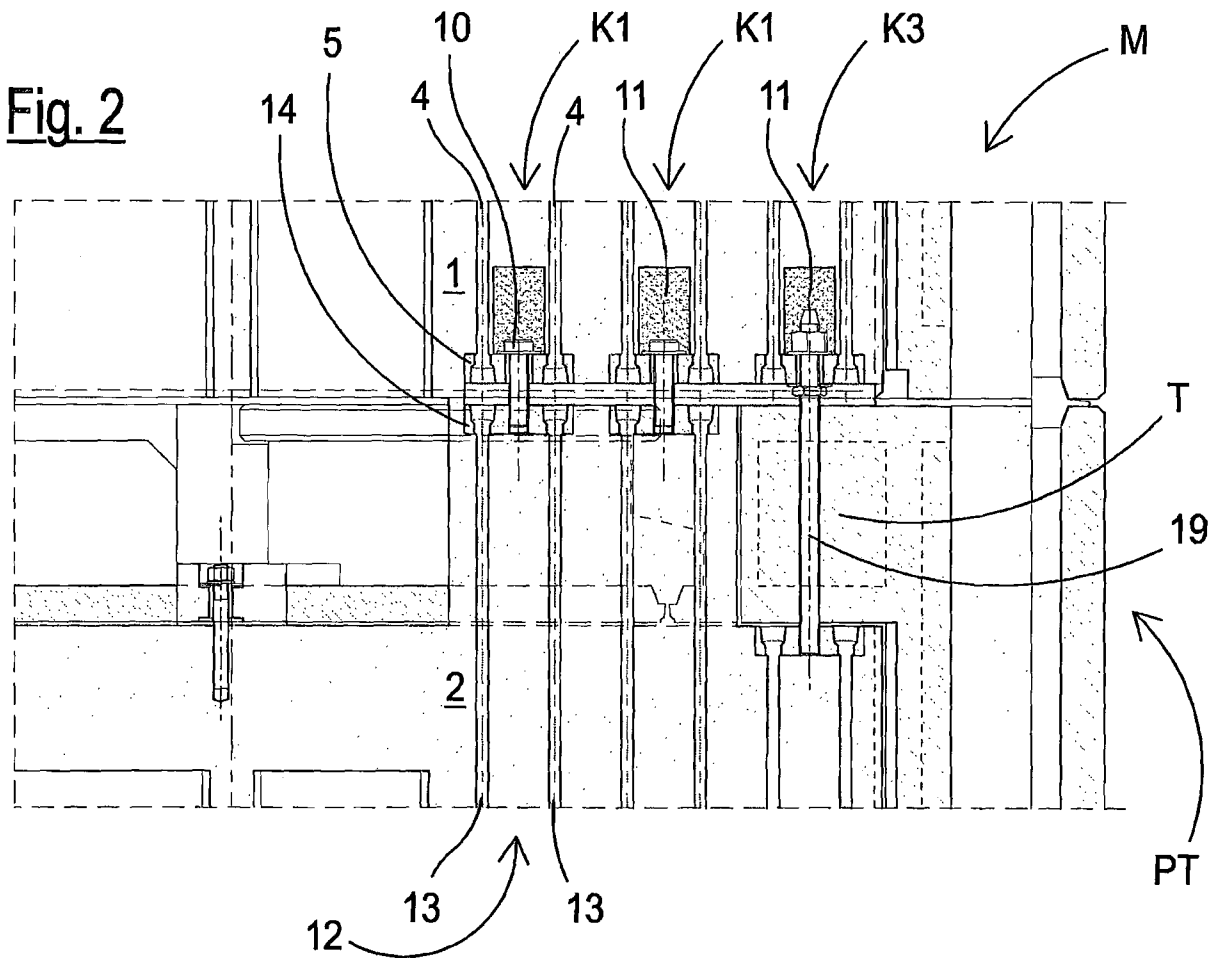

5
10
K1
K1
K3
M
14
4
4
11
11
1
T
19
2
PT
12
13
13

Fig. 3

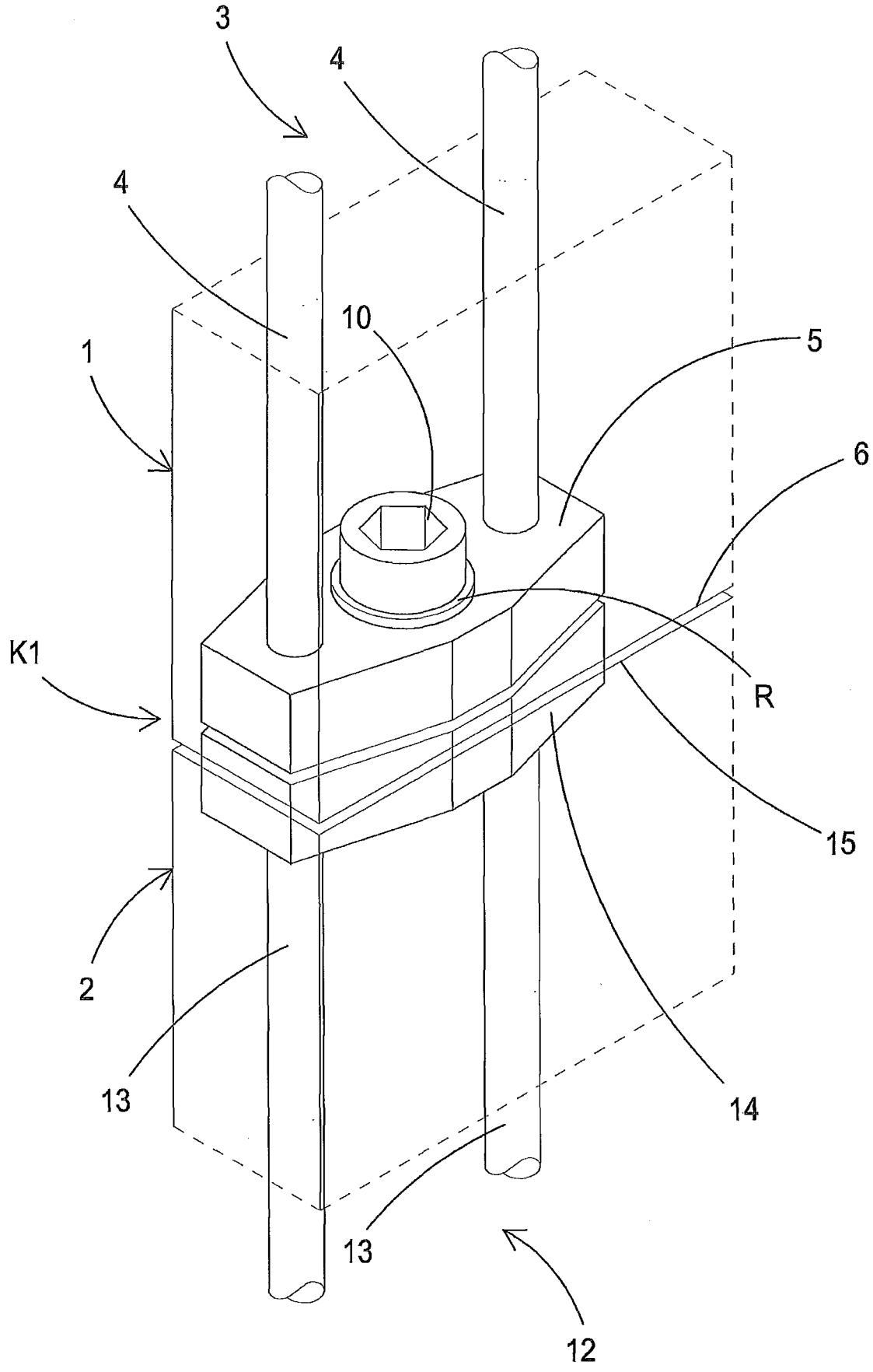


Fig. 4

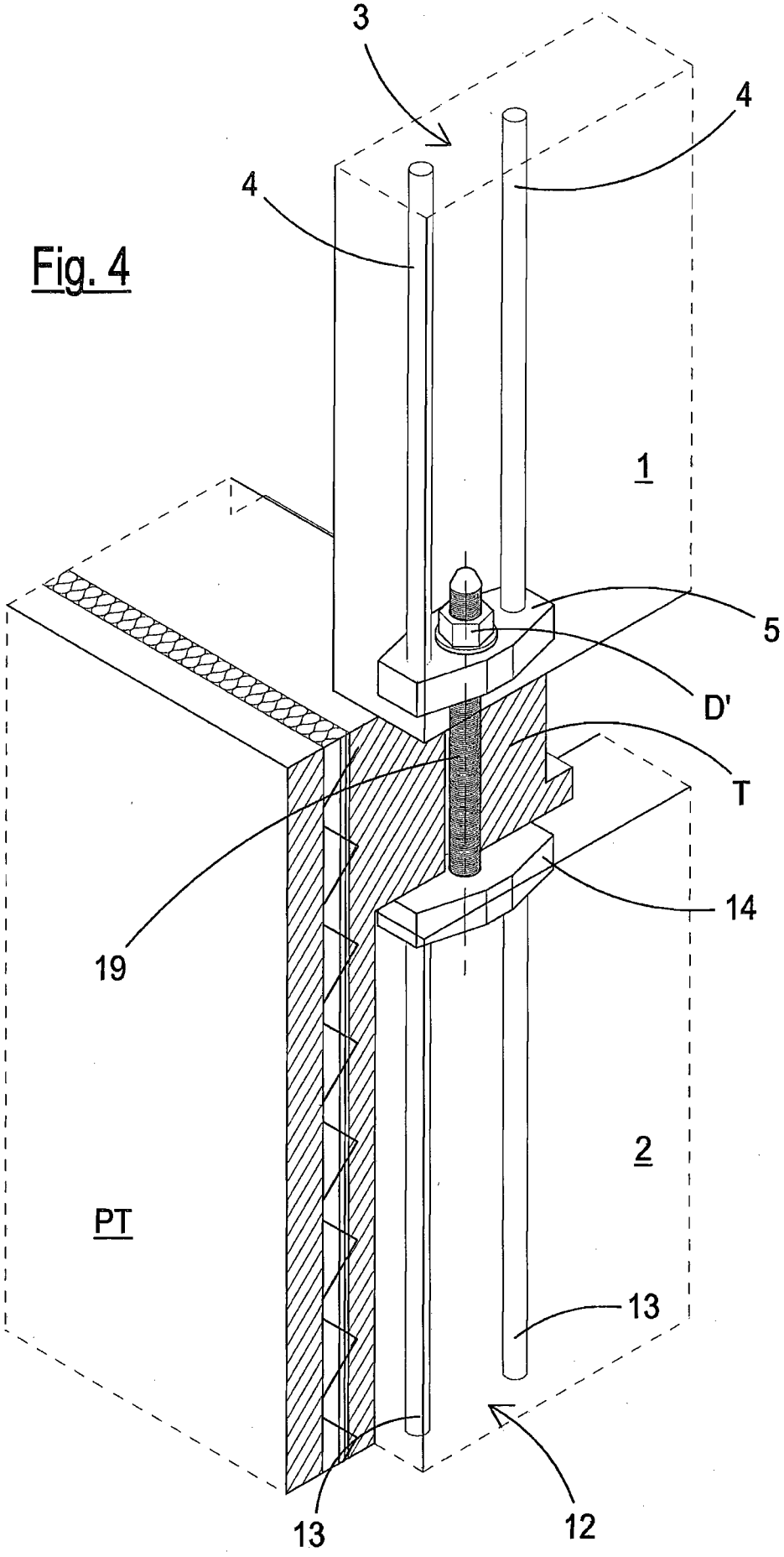


Fig. 5

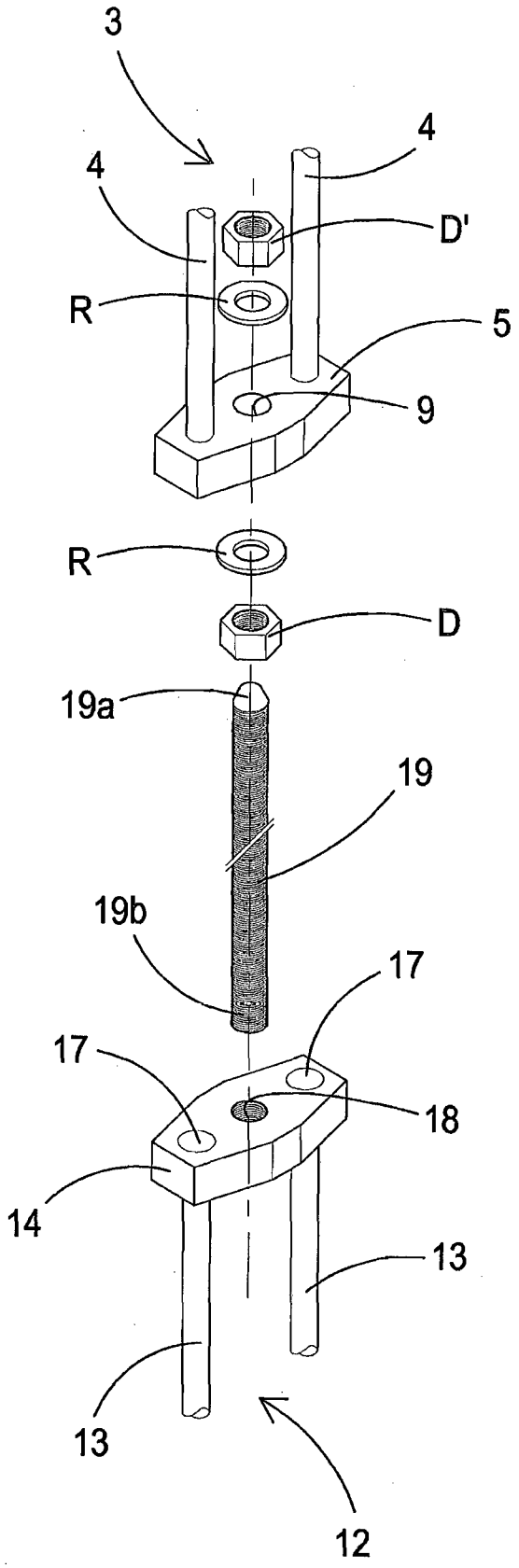

3
4
4
D'
R
5
9
R
D
19a
19
19b
17
17
18
14
13
13
12

Fig. 6

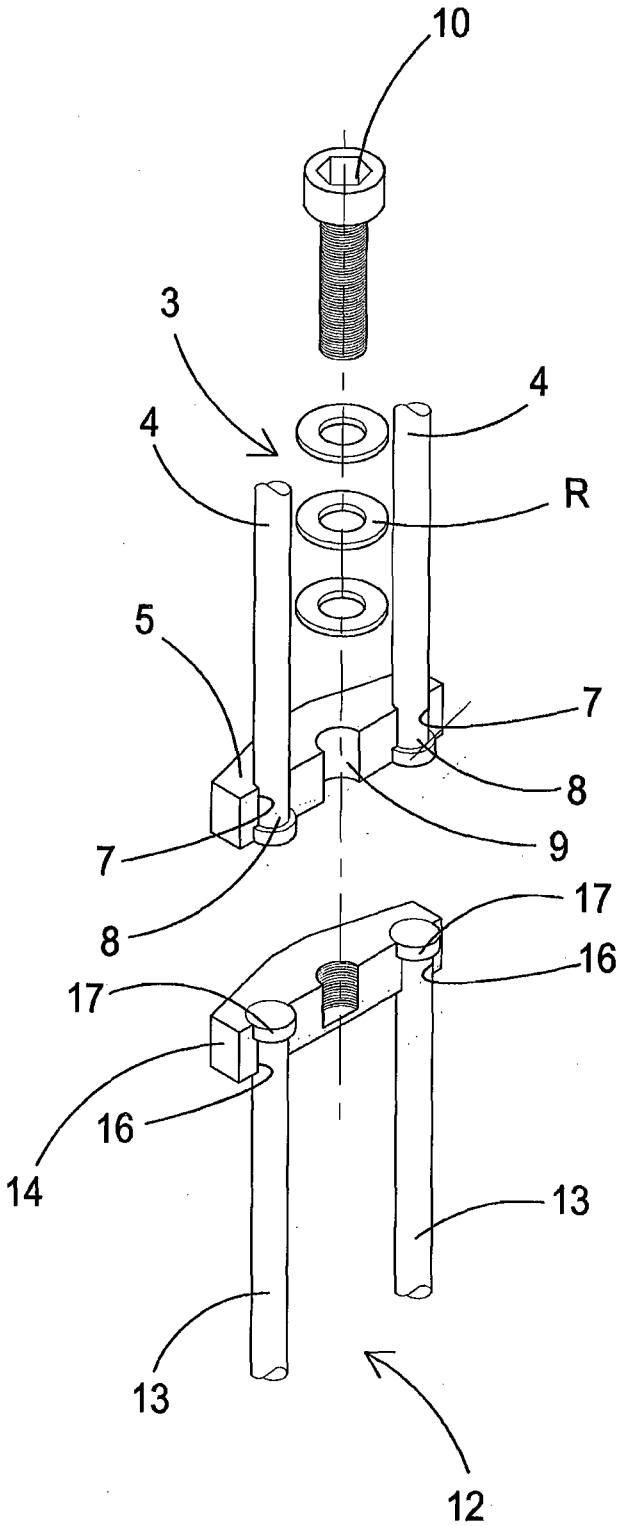

10
3
4
4
R
5
7
8
9
7
8
17
16
17
16
14
13
13
12

Fig. 7

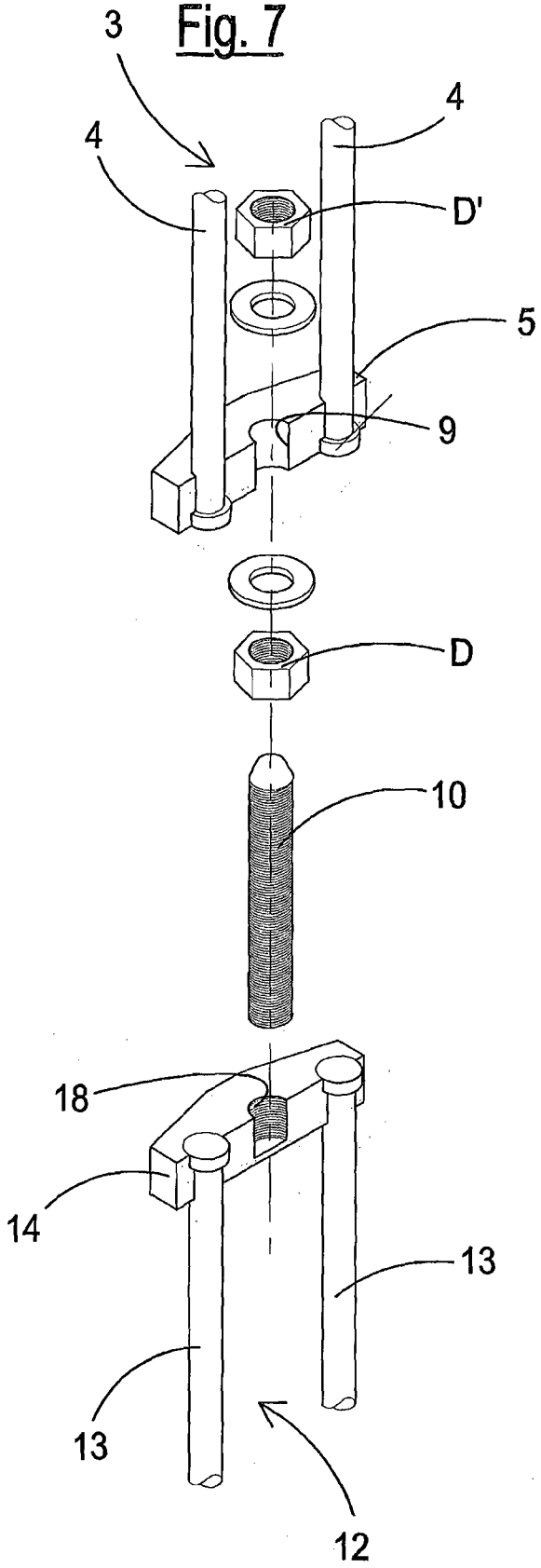


Fig. 8

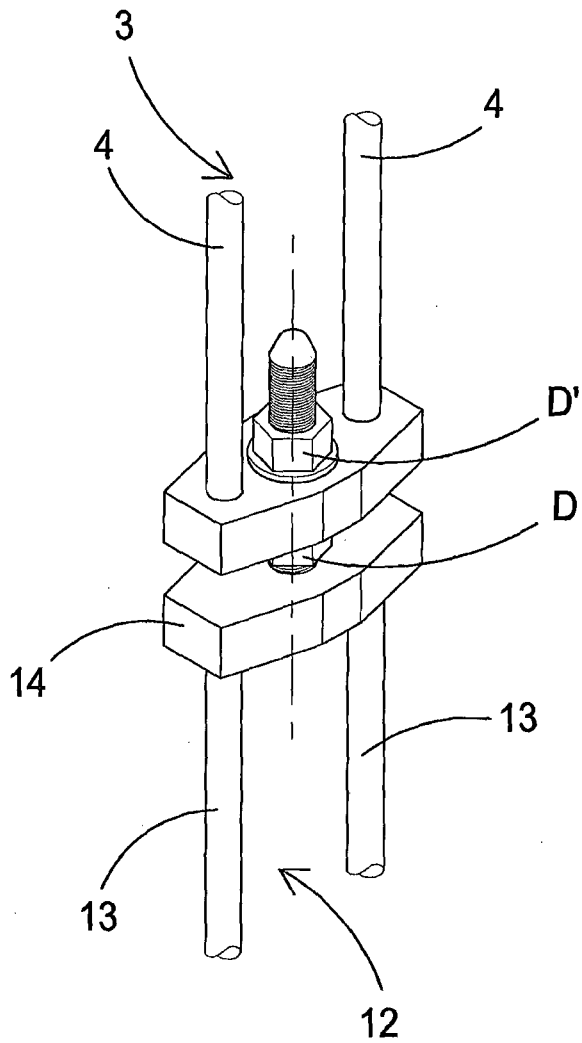
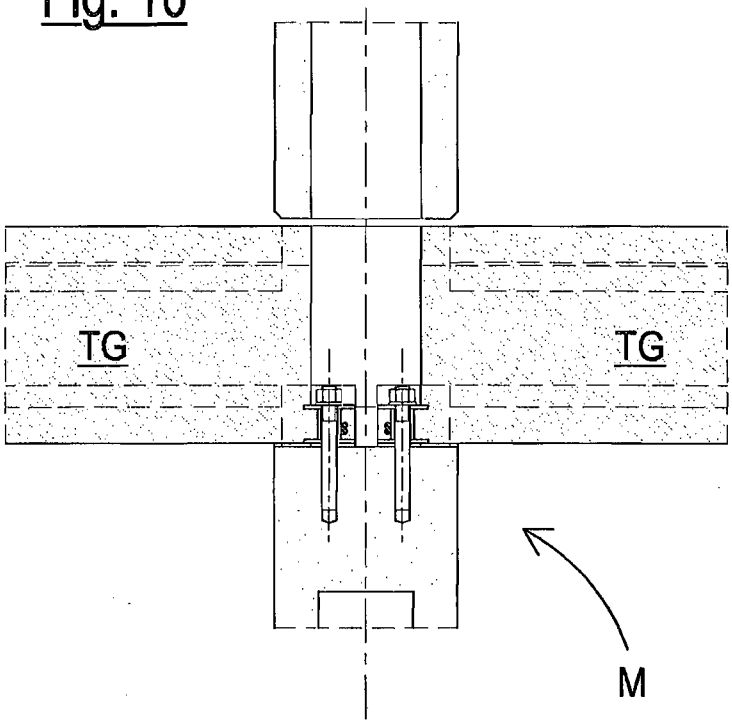


Fig. 10



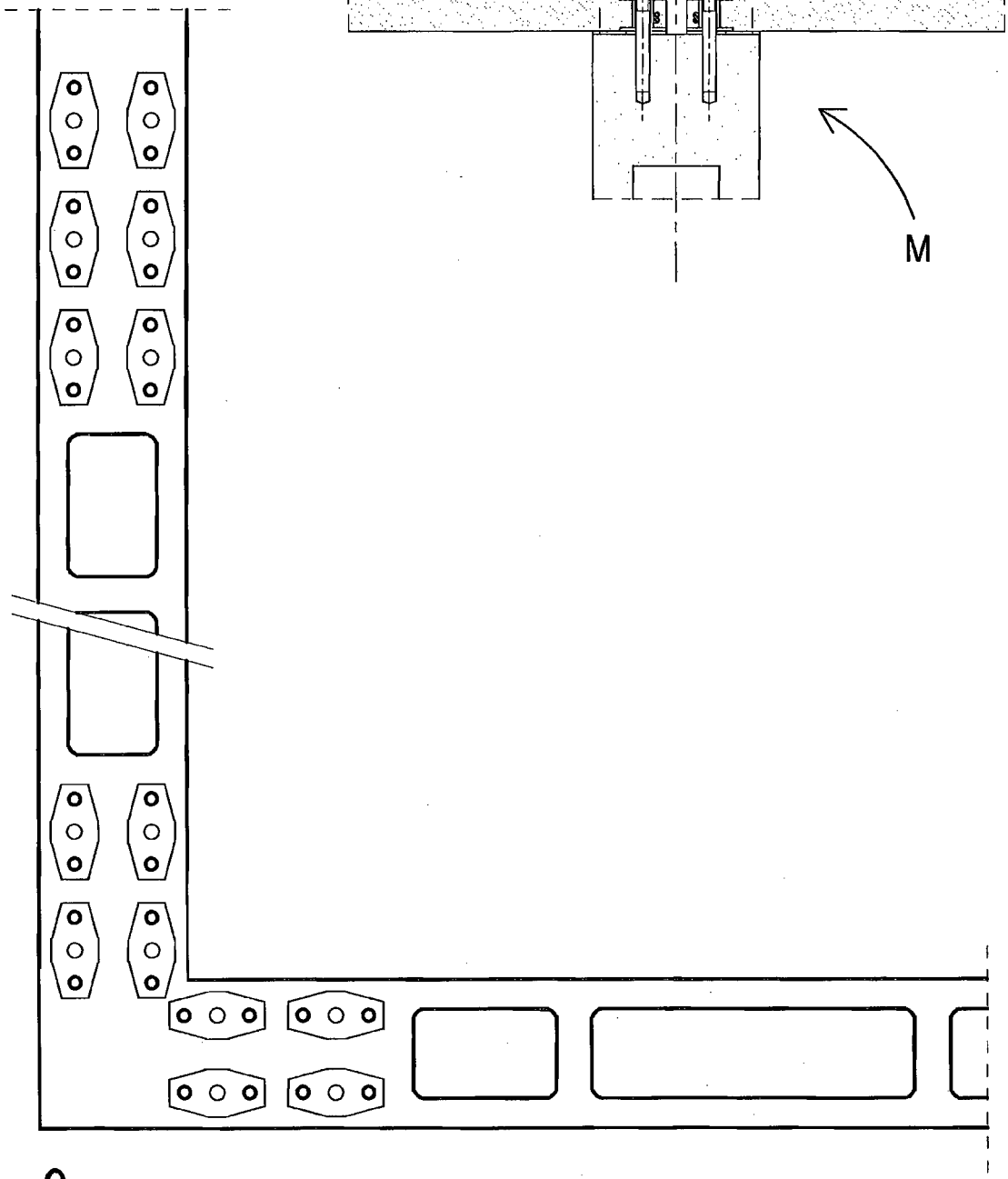


Fig. 9